An Evaluation of the
AusLink Black Spot Programme
in Tasmania

Traffic Engineering Branch
Department of Infrastructure, Energy and Resources
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1. Introduction

The AusLink Black Spot Programme is an Australian Government funded road safety improvement program. Its objective is to reduce the social and economic cost of road trauma by identifying and effectively treating locations with a high incidence or risk of casualty crashes. The Programme focuses on low-cost, high-return projects.

There are two methods for assessing and prioritising schemes: benefit-cost-ratio and safety audit. Benefit-cost-ratio projects target works to locations where there is an established history of casualty crashes. Safety audit projects are based on crash risk, targeting locations where there is little or no history of crashes but a road safety deficiency has been identified. At least 80% of AusLink Black Spot funds are to be used for benefit-cost-ratio projects.

Since the Programme started in 1996/97, the Australian Government has approved $12.8 million of projects in Tasmania. More information about the AusLink Black Spot Programme is available on the Department of Transport and Regional Services (DoTaRS) website:
http://www.auslink.gov.au/funding/blackspots/.

The Programme is administered in Tasmania by the Traffic Engineering Branch (TEB) of the Department of Infrastructure, Energy and Resources (DIER). TEB staff identify schemes through detailed crash data analysis, review nominated schemes, assess and prioritise schemes, and manage the approval process. Road owners are responsible for detailed design and construction of approved projects.

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2. Purpose

This Evaluation analyses the outcomes of the AusLink Black Spot Programme in Tasmania. The purpose of the Evaluation is to:

- Quantify the number of casualty crashes that have been prevented.
- Calculate the cost effectiveness of the Programme, in terms of crash cost savings per dollar invested.
- Improve our understanding of the impact that different types of treatments have on different types of crashes, so that we can optimise future schemes.

This Evaluation updates and extends an earlier review that was completed in May 2005. The number of schemes evaluated has increased from 37 to 70, further enhancing the statistical reliability of the results.

3. Evaluation Methodology

3.1 Crash History

The Evaluation examines the crash history before and after the construction of benefit-cost-ratio projects. The crash data is taken from DIER's Crash Data Manager computer system, which contains details of all crashes reported to the Police.

The number of casualty crashes per year that occurred before the project was undertaken is compared with the number since. The analysis assumes that if the project had not been implemented, the crash rate would have remained the same.

The number of casualty crashes per year for the 'before period' was based on seven years of crash data. The analysis ignored the crash data for the year in which the treatment was constructed. The amount of crash data available for the 'after period' varied depending on when the project was constructed. Only projects completed before the end of 2003 have been evaluated, so that at least three years of crash data was available for the 'after period'.

3.2 Casualty Crash Costs

For the people involved, the consequences of a crash can be devastating and it may seem inappropriate to place dollar values on the outcomes. However, to make decisions about road safety improvements, it is necessary to have reasonably accurate estimates of the costs of road crashes. The cost of crashes includes consideration of: emergency services, medical care, impact on quality of life, lost productivity, vehicle repairs and insurance / legal costs.

The casualty crash costs used in this Evaluation have been taken from the 'Notes on Administration for AusLink Black Spot Projects', Department of Transport and Regional Services, Australian Government (July 2006) and are reproduced in Appendix A.

Higher costs are attributed to the types of crashes that are most likely to result in serious casualties – for example, 'head on' crashes are assigned a higher cost than 'rear end' collisions. Similarly, crashes on rural roads are assigned higher costs than crashes in urban areas, because the higher speeds tend to result in more serious consequences.

3.3 Benefits and Costs

The economic appraisal calculates a benefit-cost-ratio (BCR) for each scheme, by dividing the benefits in terms of crash cost savings by the implementation and maintenance costs.

The economic benefit of a project is the difference in the average annual crash cost before and after the project's implementation. The average annual crash cost is calculated from the number and type of casualty crashes.

The implementation costs of a project include the initial capital cost for design and construction, as well as any ongoing costs. The marginal increase in ongoing costs associated with most treatments is not considered significant. However, new traffic signals are estimated to have power and maintenance costs of $5,000 per year, and improved delineation and crash barrier treatments are estimated to require refurbishment seven and fourteen years after installation at half the initial cost.

3.4 Economic Appraisal

The economic appraisal is based on a 20 year design life and a discount rate of 7%.

Road safety treatments can be expected to deliver benefits for at least 20 years. This is evidenced by the fact that many of the schemes built under the Black Spot Programme in the 1990s continue to have an excellent safety performance. Locations, such as St John Street / William Street in Launceston, where a roundabout was subsequently replaced with traffic signals have been evaluated based on the period for which the Black Spot treatment was operational.

The discount rate of 7% is recommended in the 'Notes on Administration for AusLink Black Spot Projects'. The discount rate takes the time-value-of-money into account, reflecting that a dollar today is worth more than a dollar in a year's time. The discount rate represents the rate of return that would be expected from other types of economic investment.

A worked example of how the benefit-cost-ratio is calculated is contained in Appendix B.

4. Evaluation Results

To evaluate projects at least three years of 'after treatment' crash data was required, so only projects completed before the end of 2003 have been included. Safety audit projects could not be evaluated as they are based on risk and therefore have no associated crash data for comparison. Some benefit-cost-ratio projects could not be evaluated because of difficulties in retrieving sufficiently accurate historical crash data.

A total of 70 benefit-cost-ratio schemes have been evaluated. These have been grouped into seven treatment categories so that the effectiveness of different types of treatments can be compared. The number of projects in each category is shown in the table below.

Type of Treatment	Number of Projects Evaluated
Roundabouts	15
Traffic signals	2
Improved delineation and crash barrier	13
Turn lanes and median treatments	12
Shoulder sealing	2
Traffic islands and kerb extensions	20
Modification to traffic signals	6
Total	**70**

Different types of treatments are designed to address different types of crashes. Furthermore, a treatment can reduce some types of crashes but actually increase other types. For example, traffic signals are effective at reducing right angle collisions but can increase the number of rear end collisions.

The DoTaRS 'Notes on Administration for AusLink Black Spot Projects' contain a treatment / crash reduction matrix that indicates the expected reduction (or expected increase) in various crash types for a given treatment.

The Roads and Traffic Authority (RTA) of New South Wales also produces a treatment / crash reduction matrix which is available on their website:
http://www.rta.nsw.gov.au/roadsafety/downloads/roadenvironmentsafetyupdates_dl1.html

The following sections present the results of the Evaluation and include a comparison of the crash reductions that have been achieved in practice with the estimates contained in the DoTaRS and RTA treatment / crash reduction matrices.

Detailed evaluation results for all of the projects in each category are contained in Appendix C.

4.1 Roundabouts

Roundabouts simplify the driving task by only requiring drivers to give way to traffic coming from the right. Drivers have to slow down to manoeuvre through the roundabout and so any crashes that do occur tend to be property damage only.

Evaluation results:

- 15 sites treated
- 80% reduction in casualty crashes
- 12.7 average benefit-cost-ratio (BCR)

Casualty crash reductions:

Crash type	DoTaRS expected reductions	RTA expected reductions	Actual reductions
Adjacent approach	-75%	-75%	-89%
Rear end	+20%	0%	*-71% **
Vehicle hits pedestrian	+30%	-10%	**
Loss of control	+140%	0%	*+169% **

**These reductions were based on too small a number of crashes to be statistically reliable.*
***These reductions were based on too small a number of crashes to have any statistical significance.*

Discussion:

- Roundabouts are extremely effective at reducing casualty crashes and their modest cost results in an excellent BCR.

- The 89% reduction in adjacent approach (right angle) type crashes is better than expected.

- The number of rear end collisions reduced following the installation of the roundabouts. This was true even when property damage crashes were taken into account.

- The results for rural roundabouts are not as good as urban roundabouts – the two rural roundabouts included in the evaluation had the lowest and third lowest BCRs. This is because they cost more than urban roundabouts to construct and didn't save as many casualty crashes.

4.2 Traffic Signals

Traffic signals avoid drivers turning out of side streets having to select gaps in the through traffic.

Evaluation results:

- 2 sites treated
- 71% reduction in casualty crashes
- 5.6 average benefit-cost-ratio (BCR)

Casualty crash reductions:

Crash type	DoTaRS expected reductions	RTA expected reductions	Actual reductions
Adjacent approach	-80%	-80%	*-100% **
Rear end	0%	+40%	*-22% **
Vehicle hits pedestrian	-30%	-10%	*-22% **

**These reductions were based on too small a number of crashes to be statistically reliable.*

Discussion:

- Traffic signals are very effective at reducing casualty crashes.

- The ongoing power and maintenance costs (estimated at $5,000 per year) reduce the BCR.

- At the two sites evaluated the number of casualty crashes resulting from rear end collisions reduced following the installation of signals. However, when all crashes were considered (including property damage crashes) the number of rear end collisions was found to have increased by 42%.

4.3 Improved Delineation and Crash Barrier

This type of treatment is designed to reduce the number and severity of loss of control crashes. It is particularly suited to rural or semi-rural lengths of road.

Typical improvements include:

- Provision of additional guideposts to comply with the Australian Standard.
- Provision of additional curve warning signs and advisory speed plates, and chevron alignment markers.
- Provision of thermoplastic centreline road markings, supplemented with retro-reflective pavement markers.
- Removal of roadside hazards or the installation of crash barrier.

Evaluation results:

- 13 sites treated
- 43% reduction in casualty crashes
- 5.3 average benefit-cost-ratio (BCR)

Casualty crash reductions:

Crash type	DoTaRS expected reductions	RTA expected reductions	Actual reductions
Head on	-40%	-5%	*-49% **
Loss of control	-40%	-10%	-31%

**These reductions were based on too small a number of crashes to be statistically reliable.*

Discussion:

- Improved delineation and crash barrier achieved very good reductions in the number of casualty crashes.

- This type of treatment requires regular maintenance and this reduces the BCR.

4.4 Median Treatments and Turn Lanes

Median treatments separate opposing vehicles and narrow traffic lanes. The median provides width for right turning traffic to wait for a gap without obstructing through traffic and allows pedestrians to cross the road in two stages. The narrower traffic lanes tend to reduce vehicle speeds which also improves safety.

Evaluation results:

- 12 sites treated
- 34% reduction in casualty crashes
- 6.7 average benefit-cost-ratio (BCR)

Casualty crash reductions:

Crash type	**DoTaRS expected reductions**	**RTA expected reductions**	**Actual reductions**
Head on	-90%	-40%	*-100%**
Opposing turns	-30%	-40%	-63%
Rear end	-40%	-60%	-26%
Vehicle hits pedestrian	-50%	-50%	-66%
Loss of control	-30%	0%	*+8%**

**These reductions were based on too small a number of crashes to be statistically reliable.*

Discussion:

- Median treatments and turn lanes achieved good reductions in the number of casualty crashes.

- Opposing turns reduced by 63%. This is considered to be attributable to the driver of a right turning vehicle not being intimidated by following through vehicles and consequently becoming more selective in gap acceptance.

- The reduction in rear end collisions was lower than expected.

4.5 Shoulder Sealing

Constructing sealed shoulders provides additional width for drivers to recover from losing control of their vehicle.

Evaluation results:

- 2 sites treated
- 31% reduction in casualty crashes
- 6.6 average benefit-cost-ratio (BCR)

Casualty crash reductions:

Crash type	DoTaRS expected reductions	RTA expected reductions	Actual reductions
Head on	-40%	-5%	*+4% **
Loss of control, on road	-40%	-10%	*-46% **

**These reductions were based on too small a number of crashes to be statistically reliable.*

Discussion:

- Only two shoulder sealing projects have been carried out. They achieved good reductions in the number of casualty crashes but were fairly expensive.

4.6 Traffic Islands and Kerb Extensions

Depending on the functions of the intersecting streets it may not be appropriate to disrupt traffic flow along the through route by installing a roundabout or traffic signals. Where the existing priorities are retained, safety improvements can still be made to layout.

Remodelling of junctions includes the following treatments:

- Traffic islands to make the intersection more prominent, particularly to drivers approaching along the side streets, and reduce the risk of side street drivers proceeding out into the intersection without giving way. Traffic islands also tend to reduce the speed of turning traffic and prevent corner-cutting.
- Kerb extensions allow side street drivers to stop further forward, providing drivers with better sight distance to select gaps in the traffic stream.
- Changing curve radii to ensure that vehicles turning left out of the side street are positioned to have a good view of the traffic stream they are entering.

Evaluation results:

- 20 sites treated
- 24% reduction in casualty crashes
- 5.9 average benefit-cost-ratio (BCR)

Casualty crash reductions:

Crash type	DoTaRS expected reductions	RTA expected reductions	Actual reductions
Angle collisions	-30%	-20%	-23%
Rear end	-20%	-0%	-20%
Loss of control, turning	-10%	-0%	**

***These reductions were based on too small a number of crashes to have any statistical significance.*

Discussion:

- The reduction in casualty crashes is good, but not nearly as high as other intersection treatments such as roundabouts or traffic signals.

- The BCR for this category was significantly lowered by the Bass Highway / Calder Road and Illawarra Road / Poatina Road schemes. These two rural projects accounted for half of all the funds invested in remodelling junctions.

- Other schemes were generally quite cheap and the good reduction in angle crashes resulted in excellent BCRs.

4.7 Modification of Traffic Signals

Modifications to traffic signals are designed to address specific problems:

- Sites with above average rates of angle crashes, where one vehicle must have passed through a red signal, can be improved by relocating the traffic signals to more prominent locations, possibly on new kerb extensions.
- Sites with above average rates of crashes involving right turners can be improved by the introduction of a separate right turn signal phase.
- Sites with above average rates of pedestrian crashes can be improved by constructing kerb extensions to make the pedestrians more visible and reduce the crossing distance.

Evaluation results:

- 6 sites treated
- 12% reduction in casualty crashes
- 9.3 average benefit-cost-ratio (BCR)

Casualty crash reductions:

Crash type	DoTaRS expected reductions	RTA expected reductions	Actual reductions
Remodel signals to reduce angle collisions	-50%	-20%	*-50% **
Add right turn arrows to reduce opposing collisions	-65%	-80%	**
Remodel signals to reduce pedestrian crashes	-30%	not available	*-48% **

**These reductions were based on too small a number of crashes to be statistically reliable.*
***These reductions were based on too small a number of crashes to have any statistical significance.*

Discussion:

- The overall percentage reduction in casualty crashes was fairly low because the treatments only treat specific types of crashes.
- The BCR is good because the cost of the modifications is modest.
- There was some indication that remodelling the layout to make the signals more prominent also helped to reduce rear end collisions.
- It is recognised that while the introduction of right turn phases improves safety, it creates substantially more queuing and delay.

4.8 Summary

A summary of the evaluation results for each of the different types of treatments is contained in Appendix D.

- Roundabouts are the best road safety treatment. Roundabouts delivered the greatest reduction in casualty crashes and their modest cost meant that they had the highest BCR.

- Traffic signals are very effective at reducing casualty crashes but their ongoing power and maintenance costs reduces the BCR.

- Improved delineation and crash barrier is effective at reducing the number and severity of loss of control crashes. This type of treatment requires regular maintenance and this reduces the BCR.

- Median treatments and shoulder sealing tend to be more expensive than the other types of treatment but delivered good reductions in casualty crashes and good BCRs.

- Traffic islands and kerb extensions do not reduce casualty crashes as much as roundabouts or traffic signals but their modest cost results in good BCRs.

- Modification to traffic signals only treat specific types of crashes but their modest cost results in very good BCRs.

5. Conclusions

The Evaluation has demonstrated that the AusLink Black Spot Programme in Tasmania has been very effective at reducing the number of casualty crashes at treated locations.

5.1 Cost Effectiveness of the Programme

- The average BCR for the evaluated schemes is 8.2 – meaning that for each $1 invested in road safety improvements there has been an $8 reduction in crash costs. Clearly, this represents exceptional value-for-money.

5.2 Number of Casualty Crashes Prevented

- The $5 million that has been invested in the 70 evaluated Black Spot schemes is now preventing 31 casualty crashes per year. There are approximately 1,800 casualty crashes per year in Tasmania and so this represents a 1.7% reduction.

- By the end of 2006, the 70 schemes had already prevented 209 casualty crashes, and will continue to prevent crashes for many years to come.

Appendix A – Casualty Crash Costs

Sourced from:
'Notes on Administration for AusLink Black Spot Projects', Department of Transport and Regional Services, Australian Government (July 2006)
http://www.auslink.gov.au/funding/blackspots/bs_funding_conditions.aspx

DCA Code	Crash Description	Casualty Crash Cost ($)	
		Urban Area	Rural Area
101-109	Adjacent approach	122,000	258,800
201	Head on	262,900	465,500
202-206	Opposing turns	126,900	213,600
301-304	Rear end	62,700	146,900
305-307	Lane change	95,000	238,800
308, 309	Parallel lanes, turning	83,800	188,300
001-003	Vehicle hits pedestrian	165,000	289,400
706-707	Loss of control, turning	99,100	206,800
601, 401-402	Hit parked vehicle, parking vehicle	122,900	209,500
701-702	Off road, on straight	94,100	183,800
703-704	Off road, hit object, on straight	192,100	318,400
705	Loss of control, on road, on straight	99,100	206,800
801-802	Off road, on curve	148,000	285,000
803-804	Off road, hit object, on curve	227,700	354,400
805	Loss of control, on road, on curve	104,900	188,800

Appendix B – Economic Appraisal Example

Charles Street / Albert Road, Moonah

Casualty crash history for seven years before treatment (1991-1997)
8 angle collisions

Average annual casualty crash history before treatment
1.14 angle collisions

Average annual casualty crash costs before treatment
= (1.14 x $122,000) = $139,429

Casualty crash history for eight years after treatment (1999-2006)
2 angle collisions

Average annual casualty crash history after treatment
0.25 angle collisions

Average annual casualty crash costs after treatment
= (0.25 x $122,000) = $30,500

Average annual casualty crash cost saving = $139,429 - $30,500 = $108,929

Cost of treatment = $50,000

Benefit-Cost-Ratio based on a design life of 20 years and a discount rate of 7%

Year	Annual Crash Cost Savings	Discount Factor	Net Present Value of Crash Cost Savings
1	$108,929	1.00	$108,929
2	$108,929	0.93	$101,803
3	$108,929	0.87	$95,143
4	$108,929	0.82	$88,919
5	$108,929	0.76	$83,101
6	$108,929	0.71	$77,665
7	$108,929	0.67	$72,584
8	$108,929	0.62	$67,836
9	$108,929	0.58	$63,398
10	$108,929	0.54	$59,250
11	$108,929	0.51	$55,374
12	$108,929	0.48	$51,751
13	$108,929	0.44	$48,366
14	$108,929	0.41	$45,202
15	$108,929	0.39	$42,245
16	$108,929	0.36	$39,481
17	$108,929	0.34	$36,898
18	$108,929	0.32	$34,484
19	$108,929	0.30	$32,228
20	$108,929	0.28	$30,120
Total			**$1,234,775**

Benefit Cost Ratio = Crash Cost Savings / Implementation Cost
= 1,234,775 / 50,000 = **24.7**

Appendix C – Evaluation Results

TREATMENT TYPE 1. Roundabouts

Location	Initial Cost	Year of Construction	Before Treatment: Annual Casualty Crashes	Before Treatment: Annual Casualty Crash Cost	After Treatment: Annual Casualty Crashes	After Treatment: Annual Casualty Crash Cost	Savings: Annual Casualty Crashes Avoided	Savings: Annual Crash Cost Avoided	20 Year BCR
Charles Street & Canning Street, Launceston	$35,000	1998	1.4	$180,429	0.3	$30,500	1.2	$149,929	48.5
Benjamin Terrace & Fairfax Terrace, New Norfolk	$19,984	1998	0.4	$52,286	0.0	$0	0.4	$122,000	29.6
Walker Street & Sommerville Street, Sorell	$30,000	2003	0.6	$69,714	0.0	$0	0.6	$52,286	26.3
Charles Street & Albert Road, Moonah	$50,000	1998	1.1	$139,429	0.2	$30,500	0.9	$69,714	24.7
Federal Street & Letitia Street, North Hobart	$65,000	2002	1.1	$135,700	0.0	$0	1.1	$135,700	23.7
Best Street & Percy Street, Devonport	$91,945	2001	1.3	$156,857	0.2	$19,820	1.1	$108,929	16.9
Hopkins Street & Gormanston Road, Moonah	$119,000	1998	1.3	$156,857	0.3	$28,462	1.0	$137,037	12.2
Bligh Street & Dampier Street, Warrane	$70,000	2003	0.9	$104,571	0.3	$40,667	0.5	$128,395	10.3
Austin Street & Gibbons Street, Wynyard	$84,000	1998	0.7	$87,142	0.1	$12,387	0.6	$63,905	10.1
St John Street & William Street, Launceston *	$45,000	1998	1.0	$122,000	0.0	$0	1.0	$74,755	9.8
Boxhill Road & Wyndham Road, Claremont	$110,000	2002	0.7	$86,471	0.0	$0	0.7	$86,471	8.9
Princes Street & Parliament Street, Dynnyrne	$20,000	2003	0.6	$69,714	0.3	$55,000	0.2	$14,714	8.3
Frankford Main Road & Port Sorell, Port Sorell	$165,000	1997	0.7	$154,014	0.3	$74,711	0.4	$79,303	5.3
Chapel Street & Pitcairn Street, Glenorchy	$87,000	1997	0.4	$52,286	0.2	$22,022	0.2	$30,262	3.9
Frankford Main Road & Wesley Vale Road, Port Sorell	$160,000	1999	0.4	$110,914	0.3	$73,943	0.1	$36,971	2.6
Sum for Roundabouts:	$1,151,929		12.6	$1,678,384	2.5	$388,012	10.1	$1,290,371	12.7
Average for Roundabouts:	$76,795								Combined BCR

* Roundabout replaced with traffic signals in 2002, BCR based on 4 years.

TREATMENT TYPE 2. Traffic Signals

Location	Initial Cost	Year of Construction	Before Treatment: Annual Casualty Crashes	Before Treatment: Annual Casualty Crash Cost	After Treatment: Annual Casualty Crashes	After Treatment: Annual Casualty Crash Cost	Savings: Annual casualty crashes avoided	Savings: Annual Casualty Crash cost avoided	20 Year BCR
Rosny Hill Road & Riawena Road, Rosny	$81,000	1997	1.0	$122,000	0.3	$32,267	0.7	$89,733	7.4
Goderich Street & Lindsay Street, Launceston	$188,000	1998	1.4	$119,700	0.4	$22,022	1.0	$97,678	4.5
Sum for Traffic Signals:	$269,000		2.4	$241,700	0.7	$54,289	1.7	$187,411	5.6
Average for Traffic Signals:	$134,500								Combined BCR

TREATMENT TYPE 3. Improved Delineation and Crash Barrier

Location	Initial Cost	Year of construction	Before Treatment		After Treatment		Savings		20 year BCR
			Annual Number of Casualty Crashes	Annual casualty crash cost $	Annual Number of Casualty Crashes	Annual casualty crash cost $	Annual Casualty Crashes Avoided	Annual Casualty Crash cost avoided	
Ravenswood Road, (Dean Street - Waverly Street), Ravenswood	$4,797	2001	1.4	$191,600	0.2	$38,420	1.2	$153,180	226.3
Mornington Road, Warrane	$11,566	1998	0.4	$55,171	0.3	$22,350	0.2	$32,821	20.9
Bridport Road (Allens Rd - Ocherbys Rd), Bridport	$30,000	2001	0.9	$172,357	0.4	$98,360	0.5	$73,997	18.1
Stowport Road (Bass Highway - Letteene Road), Wivenhoe	$70,000	2003	1.4	$298,086	0.7	$187,067	0.8	$111,019	11.7
Kalang Avenue, (Lumeah Ave - Bimburra Rd), Glenorchy	$60,000	2001	1.9	$257,114	1.0	$174,860	0.9	$82,254	10.1
Old Bass Highway, (Port Road - Gordon Street), Wynyard	$135,525	2002	1.9	$209,457	0.3	$56,925	1.6	$152,532	8.3
Brickport Road, Cooee	$20,000	2003	1.0	$146,071	0.7	$125,233	0.3	$20,838	7.7
Saddle Road (Back River Road - North Crescent), New Norfolk	$41,000	2002	0.4	$40,329	0.0	$0	0.4	$40,329	7.2
Brooklyn Road, Brooklyn	$12,745	2002	1.0	$101,957	0.6	$94,522	0.4	$7,435	4.3
Forth Main Road, Forth	$46,281	2002	1.0	$242,986	0.8	$231,100	0.3	$11,886	1.9
Grass Tree Hill Road, Risdon Vale	$23,000	2002	1.0	$238,500	0.8	$258,875	0.3	-$20,375	-6.5
Tasman Highway, (Holyman Ave - Pittwater Rd), Cambridge	$20,000	2001	1.0	$229,786	1.0	$377,240	0.0	-$147,454	-54.2
Henry Street, (Wildor Crescent - Dowling Street), Ravenswood	$4,797	2001	1.0	$137,100	1.6	$309,380	-0.6	-$172,280	-254.6
Sum for Improved Delineation and Crash Barrier:	$479,711		14.3	$2,320,514	8.2	$1,974,332	6.2	$346,182	5.3
Average for Improved Delineation and Crash Barrier:	$36,901								Combined BCR

TREATMENT TYPE 4. Median Treatments and Turn Lanes

Location	Initial Cost	Year of construction	Before Treatment: Annual Casualty Crashes	Before Treatment: Annual Casualty Crash Cost	After Treatment: Annual Casualty Crashes	After Treatment: Annual casualty crash cost $	Savings: Annual Casualty Crashes Avoided	Savings: Annual Casualty Crash cost avoided	20 year BCR
Regent Street (Duke Street), Dynnyrne	$32,025	1997	2.0	$248,900	0.4	$54,767	1.6	$194,133	68.7
Channel Highway (Dollery Dr - Mertonvale Circuit), Kingston	$23,602	1999	1.4	$133,957	0.3	$26,386	1.1	$107,571	51.6
Main Road (Tilyard Street - Marys Hope Road), Montrose	$20,000	1997	1.7	$210,000	1.1	$158,422	0.6	$51,578	19.5
Moriarty Road (Bass Highway - Last Street), Latrobe	$40,000	2003	0.4	$54,571	0.0	$0	0.4	$54,571	15.5
Clarence Street (Scott Street - High Street), Bellerive	$30,000	2000	1.0	$143,743	1.0	$113,750	0.0	$29,993	11.3
Albert Road (Central Avenue - Station Street), Moonah	$141,511	2000	1.0	$135,686	0.2	$10,450	0.8	$125,236	9.8
Elizabeth Street (Wilson St - McTavish Ave), North Hobart	$295,008	2000	2.4	$360,186	1.2	$190,600	1.3	$169,586	6.5
Cambridge Rd (Gordons Hill Rd - South Arm Hwy), Warrane	$175,751	1999	4.1	$416,557	2.4	$347,886	1.7	$68,671	4.4
South Arm Road (Acton Road - Bayview Road), Lauderdale	$316,250	2001	2.3	$282,100	1.0	$177,120	1.3	$104,980	3.8
Tasman Highway (Somerville St - Fitzroy St), Sorell	$236,084	2003	0.3	$47,143	0.0	$0	0.3	$47,143	2.3
Eastland Drive (Main Street - Ocean Drive), Ulverstone	$95,393	2002	1.1	$134,514	1.0	$118,375	0.1	$16,139	1.9
Mersey Road (Devonport Rd - Woodrising Ave), Spreyton	$128,019	2002	1.3	$127,486	2.5	$185,925	-1.2	-$58,439	-5.2
Sum for Median Treatments and Turn Lanes:	$1,533,643		19.0	2,294,843	11.1	1,383,681	6.5	$911,162	6.7 (Combined BCR)
Average for Median Treatments and Turn Lanes:	$136,511								

TREATMENT TYPE 5. Shoulder Sealing

Location	Initial Cost	Year of Construciton	Before Treatment		After Treatment		Savings		20 year BCR
			Annual Casualty Crashes	Annual Casualty Crash Cost	Annual Casualty Crashes	Annual Casualty Crash Cost	Annual casualty crashes avoided	Annual Casualty Crash cost avoided	
Acton Road, Clarence	$140,000	1997	2.9	$632,557	1.8	$460,689	1.1	$171,868	13.9
East Tamar Highway, Dilston	$301,000	1999	0.6	$199,471	0.6	$115,722	0.0	$83,749	3.2
Sum for Shoulder Sealing:	$441,000		3.4	$832,028	2.3	$576,411	1.1	$255,617	6.6
Average for Shoulder Sealing:	$220,500								Combined BCR

TREATMENT TYPE 6. Traffic Islands and Kerb Extensions

Location	Initial Cost	Year of Construction	Before Treatment: Annual Number of Casualty Crashes	Before Treatment: Annual casualty crash cost $	After Treatment: Annual Number of Casualty Crashes	After Treatment: Annual casualty crash cost $	Savings: Annual Casualty Crashes Avoided	Savings: Annual Casualty Crash cost avoided	20 year BCR
Cimitiere Street & Elizabeth Street, George Town	$6,338	1999	0.6	$69,714	0.1	$17,429	0.4	$52,286	93.5
Liverpool Street & Molle Street, Hobart	$15,000	2002	1.1	$141,714	0.3	$30,500	0.9	$111,214	84.0
East Derwent Highway & Nietta Road, Lindisfarne	$20,532	2001	1.1	$160,571	0.6	$61,340	0.5	$99,231	52.9
Leven Street & Jermyn Street, Ulverstone	$30,000	2001	1.1	$139,429	0.2	$24,400	0.9	$115,029	41.9
Ronald Street & Oldaker Street, Devonport	$5,822	2001	0.6	$69,714	0.4	$48,800	0.2	$20,914	39.3
Bridge Street & Franklin Street, Richmond	$20,000	2003	0.6	$65,857	0.0	$0	0.6	$65,857	36.8
Normanstone Road & Westbury Road, Launceston	$9,685	2001	1.1	$80,129	0.8	$50,160	0.3	$29,969	35.1
Springfield Avenue & Second Avenue, West Moonah	$11,500	2001	0.6	$58,100	0.2	$24,400	0.4	$33,700	33.2
Harrington Street & Patrick Street, Hobart	$50,000	1999	2.3	$258,057	1.0	$122,000	1.3	$136,057	29.8
Albert Road & Risdon Road, New Town	$15,000	2003	0.6	$48,914	0.3	$20,900	0.2	$28,014	21.2
Cambridge Road & Rosny Hill Road, Rosny	$35,000	2001	1.0	$91,929	0.4	$25,080	0.6	$66,849	20.4
East Tamar Highway & Mowbray Connector, Mowbray	$21,000	2001	1.1	$257,500	1.0	$217,420	0.1	$40,080	20.4
Claremont Link Road & Brooker Highway Off Ramp, Chigwell	$80,571	2003	0.7	$136,900	0.3	$86,267	0.4	$50,633	7.1
Middle Road & Stony Rise Road, Stony Rise	$33,533	2003	0.7	$53,257	0.3	$40,667	0.4	$12,590	4.3
Bass Highway & Calder Street, Wynyard	$303,000	2002	0.6	$147,886	0.3	$64,700	0.3	$83,186	3.0
East Derwent Highway & Gage Road, Gagebrook	$79,466	2000	1.6	$404,014	1.7	$412,683	-0.1	-$8,669	-1.2
Illawarra Main Road & Poatina Main Road, Longford	$176,462	1999	1.0	$258,800	1.3	$293,029	-0.3	-$34,229	-2.1
Regent Street & Alexander Street, Sandy Bay	$20,000	2002	0.7	$61,243	1.3	$174,000	-0.5	-$112,757	-63.9
Stewart Street & Fenton Street, Devonport	$15,000	2003	0.9	$104,571	2.3	$264,900	-1.5	-$160,329	-122.0
Arthur Highway & Old Forcett Road, Forcett	$3,727	2003	0.6	$83,943	1.3	$215,833	-0.8	-$131,890	-400.9
Sum for Traffic Islands and Kerb Extensions:	$951,636		18.6	$2,692,242	14.1	$2,194,508	4.4	$497,735	5.9
Average for Traffic Islands and Kerb Extensions:	$52,310								Combined BCR

TREATMENT TYPE 7. Modifications to Traffic Signals

Location	Initial Cost	Year of Construciton	Before Treatment: Annual Casualty Crashes	Before Treatment: Annual casualty crash cost	After Treatment: Annual Casualty Crashes	After Treatment: Annual casualty crash cost	Savings: Annual casualty crashes avoided	Savings: Annual Casualty Crash cost avoided	20 year BCR
Paterson Street & Wellington Street, Launceston	$31,080	1999	1.3	$146,057	0.4	$49,957	0.9	$96,100	35.0
Molle Street & Macquarie Street, Hobart	$45,000	2003	1.6	$220,100	1.3	$157,233	0.2	$62,867	15.8
New Town Road, Risdon Road & Forster Street, New Town	$34,934	2001	1.3	$186,186	1.2	$148,360	0.1	$37,826	13.2
Barrack Street & Macquarie Street, Hobart	$20,000	2003	1.7	$206,771	1.7	$188,900	0.1	$17,871	10.1
Bathurst Street & York Street, Launceston	$44,339	1999	0.9	$87,629	0.6	$69,714	0.3	$17,915	4.6
Augusta Road & Elizabeth Street, Hobart	$34,674	1997	0.9	$107,686	1.4	$167,644	-0.6	-$59,958	-19.6
Sum for Modifications to Traffic Signals:	$210,027		7.6	$954,429	6.6	$781,808	0.9	$172,621	9.3
Average for Modifications to Traffic Signals:	$35,005								Combined BCR

Appendix D – Evaluation Summary

SUMMARY

Treatment Type	Number of Projects	Average Cost of Treatment	Total Cost of Treatments	% Reduction in Casualty Crashes	Annual Casualty Crashes Avoided	Total Casualty Crashes Avoided by the end of 2006	20 Year BCR
1. Roundabout	15	$76,795	$1,151,929	80%	10.1	60.1	12.7
2. Traffic Signals	2	$134,500	$269,000	71%	1.7	14.9	5.6
3. Improved Delineation and Crash Barrier	13	$36,901	$479,711	43%	6.2	35.2	5.3
4. Median Treatments and Turn Lanes	12	$136,511	$1,533,643	34%	6.5	56.3	6.7
5.Shoulder Sealing	2	$220,500	$441,000	31%	1.1	9.8	6.6
6. Traffic Islands and Kerb Extensions	20	$52,310	$951,636	24%	4.4	25.7	5.9
7. Modifications to Traffic Signals	6	$35,005	$210,027	12%	0.9	6.5	9.3
Total	**70**		**$5,036,946**		**31**	**209**	**8.2**